

WHAT IS CLAIMED IS:

1. An ETC system for a toll road, comprising:
 - a road-side device;
 - 5 first means provided in the road-side device for transmitting a polling signal;
 - second means provided in the road-side device for receiving a response of an on-vehicle device to the polling signal transmitted by the first means;
 - 10 third means provided in the road-side device for deciding whether or not the second means receives the response a plural number of times; and
 - fourth means provided in the road-side device for starting next radio communications with the on-vehicle device in cases
 - 15 where the third means decides that the second means receives the response a plural number of times.
2. An ETC system for a toll road, comprising:
 - a first vehicle sensor for detecting a vehicle at a first position
 - 20 on a lane;
 - a second vehicle sensor for detecting a vehicle at a second position on the lane which is adjacently ahead of the first position;
 - first means for transmitting a polling signal when the first vehicle sensor detects a vehicle;
 - 25 second means for receiving a response of an on-vehicle device to the polling signal transmitted by the first means; and

third means for, after the second means receives the response, starting next radio communications with the on-vehicle device in cases where both the first and second vehicle sensors detect a vehicle.

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3. An ETC system as recited in claim 2, wherein the second vehicle sensor is spaced from the first vehicle sensor at an interval of about 80 cm.

- 10 4. An ETC system for a toll road, comprising:
a road-side device;
first means provided in the road-side device for implementing communications with an on-vehicle device;
second means provided in the road-side device for measuring
15 a lapse of time from a moment at which the first means starts implementing the communications with the on-vehicle device;
third means provided in the road-side device for deciding whether or not the lapse of time which is measured by the second means reaches a prescribed time interval; and
20 fourth means provided in the road-side device for maintaining the communications with the on-vehicle device which are implemented by the first means in cases where the third means decides that the lapse of time does not reach the prescribed time interval, and terminating the communications with the on-vehicle
25 device after the third means decides that the lapse of time reaches the prescribed time interval.

5. An ETC system for a toll road, comprising:
an on-vehicle device;
first means provided in the on-vehicle device for receiving
5 data from a road-side device;
second means provided in the on-vehicle device for receiving
a communication end signal from the road-side device after the first
means receives the data therefrom; and
third means provided in the on-vehicle device for handling
10 the data received by the first means as effective data regardless of
whether or not the second means successfully receives the
communication end signal.
6. An ETC system as recited in claim 5, further comprising
15 means provided in the road-side device for transmitting the
communication end signal a plural number of times.
7. An ETC system for a toll road, comprising:
a road-side device;
20 first means provided in the road-side device for receiving data
from an on-vehicle device;
second means provided in the road-side device for receiving a
communication end signal from the on-vehicle device after the first
means receives the data therefrom; and
25 third means provided in the road-side device for handling the
data received by the first means as effective data regardless of

whether or not the second means successfully receives the communication end signal.

8. An ETC system as recited in claim 7, further comprising
5 means provided in the on-vehicle side device for transmitting the communication end signal a plural number of times.

9. An ETC system for a toll road, comprising:
a first road-side antenna for providing a first radio-
10 communication service area;
first means for implementing radio communications with an on-vehicle device via the first road-side antenna;
a second road-side antenna for providing a second radio-communication service area different from the first radio-
15 communication service area;
second means for implementing radio communications with an on-vehicle device via the second road-side antenna; and
third means for controlling the first means and the second means to execute the radio communications via the first road-side
20 antenna and the radio communications via the second road-side antenna in a way selected from plural ways including a time sharing way.

10. An ETC system as recited in claim 9, wherein the plural ways
25 includes a frequency division way in which a frequency of a radio signal used in the radio communications via the first road-side

antenna differs from a frequency of a radio signal used in the radio communications via the second road-side antenna.

11. An ETC system for a toll road, comprising:

5 a first road-side antenna for providing a first radio-communication service area;

first means for implementing radio communications with an on-vehicle device via the first road-side antenna;

10 a second road-side antenna for providing a second radio-communication service area different from the first radio-communication service area;

second means for implementing radio communications with an on-vehicle device via the second road-side antenna;

15 third means for writing information related to the first road-side antenna into a memory within an on-vehicle device through the radio communications implemented by the first means;

20 fourth means for accessing a memory within an on-vehicle device through the radio communications implemented by the second means, and deciding whether or not the information related to the first road-side antenna is in the accessed memory; and

fifth means for halting the radio communications implemented by the second means when the fourth means decides that the information related to the first road-side antenna is not in the accessed memory.

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12. An ETC system as recited in claim 11, further comprising

sixth means for preventing reflection of a radio wave with respect to first radio-communication service area.

13. A method in an ETC system for a toll road, comprising the
5 steps of:

transmitting a polling signal from a road-side device;

enabling the road-side device to receive a response of an on-vehicle device to the polling signal;

- 10 deciding whether or not the road-side device receives the response a plural number of times; and

enabling the road-side device to start next radio communications with the on-vehicle device in cases where it is decided that the road-side device receives the response a plural number of times.

14. A method in an ETC system for a toll road, comprising the
15 steps of:

detecting a vehicle is at a first position on a lane;

- 20 detecting a vehicle at a second position on the lane which is adjacently ahead of the first position;

transmitting a polling signal when a vehicle at the first position is detected;

receiving a response of an on-vehicle device to the polling signal; and

- 25 after the response is received, starting next radio communications with the on-vehicle device in cases where both a

vehicle at the first position and a vehicle at the second position are detected.

15. A method in an ETC system for a toll road, comprising the
5 steps of:

enabling a road-side device to implement communications
with an on-vehicle device;

- measuring a lapse of time from a moment at which
implementing the communications with the on-vehicle device is
10 started;

deciding whether or not the measured lapse of time reaches a
prescribed time interval; and

- maintaining the communications with the on-vehicle device in
cases where it is decided that the measured lapse of time does not
15 reach the prescribed time interval, and terminating the
communications with the on-vehicle device after it is decided that
the measured lapse of time reaches the prescribed time interval.

16. A method in an ETC system for a toll road, comprising the
20 steps of:

receiving data from an on-vehicle device;

receiving a communication end signal from the on-vehicle
device after the data are received therefrom; and

- handling the received data as effective data regardless of
25 whether or not the communication end signal is successfully
received.

17. An on-vehicle device in an ETC system for a toll road,
comprising:

first means for receiving data from a road-side device;

5 second means for receiving a communication end signal from
the road-side device after the first means receives the data
therefrom; and

third means for handling the data received by the first means
as effective data regardless of whether or not the second means

10 successfully receives the communication end signal.